This Question Paper consists of 43 questions and 8 printed pages.

Roll No. | | | | | | | | | | | | |

Code No. 71/SS/313/A1

Set A1

CHEMISTRY
(313)

Day and Date of Examination .....

Signature of Invigilators 1. .....

2. .....

General Instructions **:**

1. Candidate must write his/her Roll Number on the first page of the Question Paper.
2. Please check the Question Paper to verify that the total pages and total number of questions contained in the Question Paper are the same as those printed on the top of the first page. Also check to see that the questions are in sequential order.
3. Making any identification mark in the Answer-Book or writing Roll Number anywhere other than the specified places will lead to disqualification of the candidate.
4. Write your Question Paper Code No. 71/SS/313/A1, Set A1 on the Answer-Book.
5. (a) The Question Paper is in English medium only. However, if you wish, you can answer in any one of the languages listed below :

   English, Hindi, Urdu, Punjabi, Bengali, Tamil, Malayalam, Kannada, Telugu, Marathi, Odia, Gujarati, Konkani, Manipuri, Assamese, Nepali, Kashmiri, Sanskrit and Sindhi.

   You are required to indicate the language you have chosen to answer in the box provided in the Answer-Book.

   (b) If you choose to write the answer in the language other than Hindi and English, the responsibility for any errors/mistakes in understanding the questions will be yours only.

CHEMISTRY
(313)

Time : 3 Hours] [Maximum Marks : 80

Note : (i) This Question Paper consists of 43 questions in all.

(ii) *All* questions are compulsory.

(iii) Marks are given against each question.

(iv) Use log tables if necessary.

(v) Section–A consists of

(a) Question Nos. **1** to **16** (multiple choice type questions (MCQs) carrying *1* mark each). Select and write the most appropriate option out of the four options given in each of these questions.

(b) Question Nos. **17** to **28** (objective type questions) carry *2* marks each (with 2 sub-parts of *1* mark each). Attempt these questions as per the instructions given for each.

(vi) Section–B consists of

(a) Question Nos. **29** to **37** (very short answer type questions carrying *2* marks each) to be answered in the range of *30* to *50* words.

(b) Question Nos. **38** to **41** (short answer type questions carrying *3* marks each) to be answered in the range of *50* to *80* words.

(c) Question Nos. **42** and **43** (long answer type questions carrying *5* marks each) to be answered in the range of *80* to *120* words.

An internal choice has been provided in some of these questions in Section–B. You have to attempt only one of the given choices in such questions.

(1) Answers of all questions are to be given in the Answer-Book given to you.

(2) 15 minutes time has been allotted to read this Question Paper. The Question Paper will be distributed at 2:15 p.m. From 2:15 p.m. to 2:30 p.m., the students will read the Question Paper only and will not write any answer on the Answer-Book during this period.

SECTION–A

Note : Question Nos. **1** to **16** are Multiple Choice type Questions (MCQs) of *1* mark each.

1. The mass number of an atom of an element is

(A) number of protons + number of electrons

(B) number of protons + number of neutrons

(C) atomic number – number of neutrons

(D) atomic number + number of electrons 1

2. Which of the following will ***not*** form a sigma bond if *X*-axis is the internuclear axis? 1

(A) 1*s* and 1*s* (B) 1*s* and $2p_x$

(C) $2p_y$ and $2p_y$ (D) 1*s* and 2*s*

3. Which of the following species have the same number of electrons? 1

(A) $_{11}Na^{+}$ and $_{19}K^{+}$ (B) $_{20}Ca^{2+}$ and $_{16}S^{2-}$

(C) $_{12}Mg^{2+}$ and $_{20}Ca^{2+}$ (D) $_{12}Mg^{2+}$ and $_{16}S^{2+}$

4. The number of moles of carbon atoms in three moles of ethane is

(A) 2 (B) 3

(C) 4 (D) 6 1

5. Which is ***not*** affected by temperature? 1

(A) Molarity (B) Molality

(C) Normality (D) Mass percentage

6. The enthalpies of elements in their standard states are taken as zero. The enthalpy of formation of a compound

(A) is always positive (B) is always negative

(C) is never negative (D) may be positive or negative 1

7. Which of the following statements is ***incorrect*** in the case of heavy water? 1

(A) It is used as a moderator in nuclear reactor.

(B) It is used in the study of the mechanism of chemical reactions involving hydrogen.

(C) It is more effective as solvent than ordinary water.

(D) Heavy water is more associated than ordinary water.

8. Which of the following bonds is the strongest? 1

(A) F—F (B) Cl—Cl

(C) Br—Br (D) I—I

9. The minimum number of oxidation states is shown by which *d*-block element? 1

(A) Sc (B) Ti

(C) Cu (D) Zn

10. The groups with $-I$ effect are

(A) —H, $—NO_2$ (B) —OH, —I

(C) —H, $—CH_3$ (D) $—(CH_3)_3C$, $—CH_3$ 1

11. Oxidation of ethyne with cold alkaline $KMnO_4$ produces

(A) ethanoic acid (B) ethane

(C) ethanedioic acid (D) ethene 1

12. The organometallic compound of magnesium with an alkyl halide is called

(A) Schiff's reagent (B) Baeyer's reagent

(C) Grignard reagent (D) Tollen's reagent 1

13. In Lucas' test, turbidity does not appear for

(A) primary alcohols

(B) secondary alcohols

(C) tertiary alcohols

(D) both primary and secondary alcohols 1

14. Ethanoic acid on treatment with P_2O_5 produces

(A) propanoic acid (B) ethene

(C) ethanoic anhydride (D) ethanol 1

15. Clemmensen reduction is carried out with

(A) $LiAlH_4$ in ether (B) H_2 in the presence of Pd

(C) NH_2NH_2/glycol and KOH (D) Zn-Hg and HCl 1

16. Carboxylic acids react with alcohols to form

(A) esters (B) anhydrides

(C) substituted acids (D) acid chlorides 1

Note : Question Nos. **17** to **28** are the objective type questions of *2* marks each.

17. Complete the following by the given options : 1×2=2

$4s$, $4p$, $3s$, $1s$

(a) According to Aufbau principle, $3d$ has lower energy than _____.

(b) Two spherical nodes will be present in _____ orbital.

18. Read the passage given below and answer the following questions : 1×2=2

NH_3 has a pyramidal structure which makes the arrangement of three N—H bonds unsymmetrical. In each N—H bond, nitrogen is the negative centre and hydrogen is the positive centre.

(a) How many lone pairs of electrons are present in NH_3 molecule?

(b) Draw a diagram of NH_3 molecule depicting the direction of net dipole of the molecule.

19. Write *True* (T) for correct statement and *False* (F) for incorrect statement : 1×2=2

(a) In acetylene molecule, the two carbon atoms are joined by one sigma bond and two pi bonds.

(b) Be_2 molecule does not exist because its bond order is a fraction.

20. Read the passage given below and answer the following questions : 1×2=2

In sodium chloride molecule, the positively charged sodium ion and the negatively charged chloride ion are held together by electrostatic attractions. The bond so formed is called an ionic bond.

(a) State the signs of ΔH for formation of both Na^+ and Cl^- ions.

(b) Why are Na^+ and Cl^- ions formed?

21. Complete the following by the given options : 1×2=2

(diamagnetic, paramagnetic, coloured, colourless)

(a) $[Fe(CN)_6]^{3-}$ molecule is _____.

(b) Transition metal ions are _____.

22. Read the passage given below and answer the following questions : 1×2=2

In the crystal lattice of the elements of the transition series, elements can easily replace another element forming solid solutions and smooth alloys.

(a) State the essential condition for the formation of alloys.

(b) What is the percentage composition of brass?

23. Complete the following by the given options : 1×2=2

(oxygen, ozone, hydrogen peroxide, zinc oxide, nitric oxide)

(a) Mercury sticks to the glass when it is exposed to _____.

(b) _____ is an amphoteric oxide.

24. Match the items in Column–I with Column–II : ½×4=2

Column–I	*Column–II*
(a) Li > Na	*(i)* Atomic property
(b) Be < Mg	*(ii)* Density
(c) Mg > Na	*(iii)* Ionization energy
(d) Li < Na > K	*(iv)* Melting points

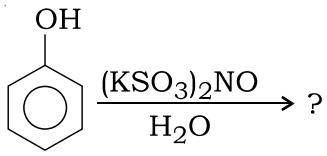
25. Read the passage given below and answer the following questions : 1×2=2

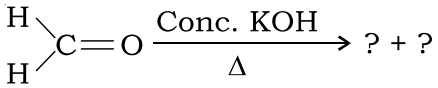
Benzenediazonium salt is formed by treating an aromatic primary amine with $NaNO_2$ and dil. HCl at low temperature.

(a) Name the process stated in the above passage.

(b) Write the chemical equation for Gattermann reaction.

26. Complete the following reactions : 1×2=2

(a) 

(b) 

27. Write *True* (T) for correct statement and *False* (F) for incorrect statement : 1×2=2

(a) Butyl rubber is obtained on co-polymerization of butadiene and isobutylene.

(b) Natural rubber has higher tensile strength than vulcanised rubber.

28. Read the passage given below and answer the following questions : 1×2=2

Biodegradable polymers can be broken into small segments by enzyme-catalyzed reactions. The required enzymes are produced by microorganisms.

(a) How can non-biodegradable polymers be converted into biodegradable polymers?

(b) Give full name of a biodegradable polymer.

SECTION–B

Note : Question Nos. **29** to **43** are the subjective type questions. An internal choice has been provided in some of these questions. You have to attempt only one of the given choices of such questions.

29. How much copper can be obtained from 100 g of copper sulphate? (Atomic mass of Cu = 63·6, S = 32·0, O = 16·0) 2

Or

Calculate the amount of carbon dioxide that could be produced when 1 mole of carbon is burnt in air.

30. State Raoult's law for solutions. Give its mathematical expression. 2

31. What is the value of van't Hoff factor for a dilute solution of K_2SO_4 in water? 2

Or

Why does the vapour pressure of a liquid decrease when a non-volatile solute is added to it?

32. Define the term 'enthalpy of fusion' with an example. 2

Or

Define the term isolated system. Give an example.

33. Describe the composition of a standard hydrogen electrode. 2

34. Which atoms in the following pairs of atoms are expected to have higher ionization enthalpy? 2

(a) $_4$Be and $_5$B

(b) $_2$He and $_{10}$Ne

35. What is meant by conjugate acid-base pair? Find the conjugate acid-base in the following reaction : 2

$$NH_3(aq) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

Or

A basic buffer is made by mixing ammonium hydroxide and ammonium nitrate in water. Explain how this buffer will resist change in its pH on addition of a small amount of an acid or a base.

36. Write the chemical equations of the reactions which take place in Castner-Kellner cell for the manufacture of sodium hydroxide. 2

37. Write chemical equations for—

(a) Reimer-Tiemann reaction;

(b) coupling reaction. 2

38. A solution contains 0·8960 g of K_2SO_4 in 500 ml. Its osmotic pressure is found to be 0·69 atm at 27 °C. Calculate its molecular mass (R = 0·0821 L atm K^{-1} mol^{-1}). 3

39. Enthalpies of formation of CO(g), CO_2(g), N_2O(g) and N_2O_4(g) are –110, – 393, 81 and 9·7 kJ mol^{-1} respectively. Find the value of $\Delta_r H$ for the reaction

$$N_2O_4(g) + 3CO(g) \rightarrow N_2O(g) + 3CO_2(g)$$ 3

Or

Enthalpy of combustion of carbon to CO_2 is – 393·5 kJ mol^{-1}. Calculate the heat released upon formation of 35·2 g of CO_2 from carbon and dioxygen gas.

40. Define the term 'solubility product' and explain. 3

41. Calculate Λ_m^∞ for acetic acid, given

$\Lambda_m^\infty(HCl) = 426\ \Omega^{-1}\ cm^2\ mol^{-1}$

$\Lambda_m^\infty(NaCl) = 126\ \Omega^{-1}\ cm^2\ mol^{-1}$

$\Lambda_m^\infty(CH_3COONa) = 91\ \Omega^{-1}\ cm^2\ mol^{-1}$ 3

Or

Calculate the reduction potential of the following half-cell at 298 K :

$Ag^+(0 \cdot 1\ M) + e^- \rightarrow Ag(s)$

$E° = 0 \cdot 80$ V

42. *(a)* How is potassium dichromate manufactured from chromite ore? Give chemical equations.

(b) Give IUPAC names of the following complexes :

(i) $[Co(H_2O)_6]Cl_3$

(ii) $K_2[PtCl_6]$ 5

Or

(a) How does sulphur dioxide act as a reducing agent? Illustrate it with an example.

(b) How can XeO_3 be prepared? Give its chemical equation. Also draw the structure for XeO_3 and state its shape.

43. *(a)* Give chemical equation for halogenation reaction in alkanes.

(b) How will you distinguish between haloalkane and haloarene?

(c) Mention *two* uses of methanol. 5

Or

(a) Name the reaction in which aldehydes having α-hydrogen atoms on reaction with dil. NaOH give aldols. Illustrate with an example.

(b) Which dehydrating agent produces an anhydride from a carboxylic acid? Write a chemical equation for it.

★ ★ ★